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Against World Hunger

President Johnson has urged a program of "Food for Freedom" to help combat world hunger that "poisons the mind . . . saps the body . . . and destroys hope."

Backing up this proposal, Secretary Freeman has named A. M. Altschul to spearhead a broad USDA effort to find new sources of high-protein and high-energy foods. Protein deficiency is responsible for widespread malnutrition and deaths in many parts of the world.

Altschul is internationally known for his research in biochemistry and food science and has served as a consultant on vegetable proteins to various United Nations agencies. He is head of the ARS Seed Protein Pioneering Research Laboratory at New Orleans, a post held since 1958. In his new assignment, Altschul will work with research scientists of USDA and other Federal agencies, and the food industry, to develop protein foods from crops grown in regions that are short in meat, milk, and eggs.

Having broad experience with high-protein crops, ARS scientists are in an excellent position to carry out this work. They know, for example, that three seed crops—soybeans, cottonseed, and peanuts—are grown in many parts of the world where animal products are in short supply. Since each is high in protein and energy, they asked, why couldn't edible flours be developed from them? They believe they can (see "Soybean Flour—In Five Easy Steps," pages 8–9, this issue).

In earlier work, ARS utilization chemists at New Orleans, seeking broader markets for cottonseed meal as a livestock feed, found a method of removing a toxic pigment called gossypol from cottonseed (AGR. RES., February 1963, page 13). By eliminating this objection to cottonseed meal as a feed, they may also have paved the way for a new source of food—cottonseed flour.

ARS is working with the Agency for International Development (AID) and the United Nations Children's Fund (UNICEF) to make sure that, once a new food is found, it can be put to use enrichening protein-poor diets. This means developing low cost and practical methods that can be used by underdeveloped nations, training people to introduce the new processes, and evaluating the foods for acceptability by people in these nations.

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U.S. Department of Agriculture

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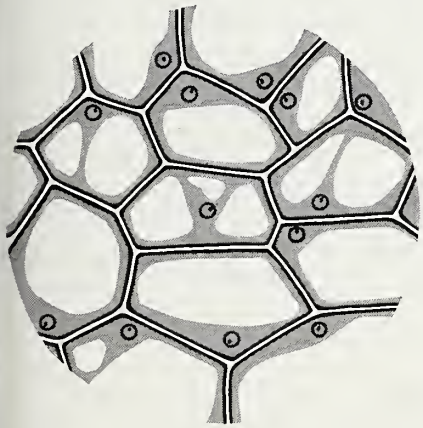
Agricultural Research Service

How Does Salinity Affect Plant Growth?

Basic studies show that sensitivity to excess salt decreases as 24-hour growth cycle of radishes progresses



■ ARS scientists at the U.S. Salinity Laboratory, Riverside, Calif., are learning that salinity can be the proverbial "monkey wrench" that disrupts the sequence of "production-line" steps in cell division and plant growth.

Salinity, they are finding, holds up the production of new cells, but the plant's light-controlled biological clock, which starts the day's 24-hour schedule for complete cell division, continues to run.

And because the time allotted for cell division is fixed, inhibiting this division—even temporarily—can permanently reduce the number of cells produced and size of plant.

A complete understanding of how this happens could lead to the development of plant varieties that are more tolerant to saline soils. This would also mean more water—perhaps brackish water—would be available to farmers for irrigation of crops.

To find out how salinity retards plant growth, the Riverside scientists are studying its effect on the most basic processes in plant growth— cell division.

They know, for example, that plants grow by a division of cells that occurs in an orderly 24-hour sequence or cycle beginning at dawn. First, the cells enlarge, then the synthesis of ribonucleic acid (RNA) and protein begins. RNA carries out genetic instructions from the cell's nucleus and supervises the synthesis of new cell material.

Once RNA and protein synthesis in the cell reach certain stages, the synthesis of dioxyribonucleic acid (DNA) begins. DNA contains the genetic code of the cell. It holds all the hereditary information necessary for cells to duplicate themselves and for plants and animals to develop and maintain varietal and individual identities.

The RNA and protein that are synthesized in the first phase of the division cycle furnish both the raw material and the instructions for using this material to synthesize a copy of the cell's DNA. The copy will be the genetic code of the new cell after the cell divides. RNA and protein—on instruction from DNA—also make all other material needed by the new cell.

Usually, when the DNA of the cell is duplicated, the cell divides and the plant grows.

The length of time it takes a cell to divide varies, but in higher, seed-bearing plants, it takes about 1 day. In leaves, for example, expanding cells enlarge for a period of 4 hours. Then, RNA synthesis begins, accompanied by a small amount of protein synthesis. DNA synthesis and major protein synthesis begin 12 hours after cells start to enlarge.

In one of a series of Riverside tests, plant physiologist R. H. Nieman introduced saline solution to radish cotyledons that had been held in the dark. Then, he started the cell-division cycle in the leaves by placing them in light. He also salinized other radish cotyledons in various phases of cell division—after 4, 8, 12, and 16 hours of light.

In subsequent examinations, Nieman found that all phases of the cell-division cycle were not affected simultaneously nor to an equal degree. First, cell enlargement was suppressed. Second, RNA and protein synthesis were suppressed. And finally, DNA synthesis was suppressed.

Suppression of cell division was greatest when the leaves were salinized at the beginning of RNA synthesis—that is, 4 hours after light had been applied and the division cycle began. Salination during this period (the equivalent of midmorning) inhibited synthesis of RNA's and proteins essential for DNA synthesis, having much the same effect as the stress field crops undergo in midmorning when there is a lack of moisture. (The scientists believe, however, it would probably be better to irrigate with salty water during midmorning than to permit a crop to undergo stress.)

But after the first 4 hours in the cycle, sensitivity to excess salt decreased slowly until the twelfth hour and then dropped abruptly as DNA synthesis started. Apparently, after some RNA has been synthesized, salt will have less effect on cell division than when no RNA has been synthesized. And when enough RNA has been synthesized so that DNA synthesis is well underway before the plant is salinized, salt will have little effect on cell division.☆

RIGHT—In early experiments, the sealer was put on over a tack coat of asphalt. Later, this treatment was found to be unnecessary. BELOW—After cracks in the concrete are jetted clean (background), the sealer is applied. Workmen can treat 800 feet of cracks in 1 hour. (Photo Nos. PN–1350 and PN–1351)

SAVING WATER

For Western Irrigators

Conservation engineers develop quick, lasting bond for sealing cracks in irrigation canals

■ A way to save billions of gallons of valuable—and s c a r c e—irrigation water has been developed by ARS water-conservation scientists for use in western States.

It consists of an improved sealer and an efficient method of applying it to weather-cracked concrete irrigation canals. Using the new technique, three men can treat 800 feet of cracks, requiring about 10 gallons of sealer, in an hour's time.

The need for a quick and effective sealer is illustrated in Arizona, where about 7,000 miles of concrete-lined canals lose an estimated 20 million acre-feet of water each year. Before a canal in Arizona's Salt River Project was repaired, it lost 2,800 acre-feet of water per mile each year, at a cost of about $8,400 per mile of canal.

In 1963, soil scientist R. J. Reginato and director L. E. Myers of the U.S. Water Conservation Laboratory at Phoenix began developing and testing improved materials and methods for sealing cracks in concrete canals. At that time, commonly used repair methods were laborious and expensive, frequently requiring hand cleaning of cracks and troweling on mastic-type sealers.

Working in cooperation with the Arizona Agricultural Experiment Sta-

tion and the Salt River Project of Arizona, the researchers developed a sealer that can be sprayed on the cracks with high-pressure pumps and nozzles. The sealer is a mixture of asphalt, butyl latex, and asbestos fiber.

Previous asphalt-base sealers could be easily peeled from concrete, the scientists explain, because the bonds were mechanical. Concrete has a negative-charged surface, so the researchers added positive-charged agents to their formulation forcing the sealer and concrete to form an electrochemical bond.

The ARS-developed sealer, and one that became available commercially during the test period, were compared with conventional mastic sealers on various concrete-lined canals. Also tested were several methods of pretreating cracks before applying sealer. These pretreatments included wire brushing, sweeping with bristle brooms, or jetting with water. Some cracks were given a coat of cutback asphalt or kerosene; others were not.

Cleaning with the high-pressure water jet (400 to 500 pounds per square inch), without the tack coat, was the most satisfactory method of preparing the cracks for sealing. It blasted the soil out of the cracks and removed all silt and algae around their edges. Fine silt-covered cracks that might otherwise have been missed were quickly and easily traced with the water jet, the scientists say.

Sealer sprayed directly on the clean, wet concrete at 1,500 pounds per square inch pressure produced a superior bond. After 1 year, there were no bonding failures and the sealer could not be scraped from the concrete with a knife.

For efficiency, the scientists say, three men are required for the new method of crack treating. One man jets the cracks, one sprays on the sealer, and one drives a truck laden with pumps, sealer, and water supply along the canal.☆

INFECTS ONE HOST, NOT ANOTHER...

WHY?

Differences in body temperature may be the answer, says research microbiologist

■ Basic research is giving some insight into why some strains of disease organisms affect one host but not another. In the case of ornithosis, this research is also indicating why some turkeys are able to throw off infections of this pneumonia-like disease while other turkeys cannot.

Ornithosis is caused by a microorganism that belongs somewhere between the viruses and bacteria and is visible under an ordinary microscope. It is susceptible to antibiotics.

There are many strains of this microorganism, including those that cause, besides turkey ornithosis, pigeon ornithosis, sheep abortion, and sheep polyarthritis (AGR. RES., November 1965, p. 15). Other strains infect humans with a disease that used to be known as parrot fever and is caused by contact with sick parrots and other birds, as well as some mammals. And one strain may affect several different species of birds or mammals.

In an attempt to learn more about the relationships between strains of this microorganism and the ability of wild birds to infect domestic herds and flocks, cross susceptibility experiments were conducted by ARS research microbiologist L. A. Page at the National Animal Disease Laboratory, Ames, Iowa.

Among other things, Page found that the sheep polyarthritis strain severely affects the legs and airsacs of turkeys. He also found that the turkey ornithosis agent is fatal to turkeys and other laboratory animals but does not affect pigeons or sparrows—even though the pigeon ornithosis agent affects turkeys.

To find out why turkeys catch the pigeon disease but the pigeons do not get the turkey disease, Page narrowed his research to just the strains of microorganisms causing these diseases. Pigeons and sparrows, he found, are probably more resistant to turkey ornithosis because they have normal body temperatures ranging from 110–112° F. as compared to about 104° for turkeys.

In testing the effect of heat on the pigeon and turkey strains of ornithosis, Page determined the inactivation rates of the two strains at various temperatures. The turkey strain—which always failed to cause disease in pigeons—was rapidly killed when stored at the normal body temperature of pigeons. Although the pigeon disease agent was eventually killed, it survived these temperatures much longer.

Page says this suggests that fever may aid those individual turkeys that overcome infection. The majority of turkeys having a fever approaching 109° for a prolonged period after they were inoculated with the turkey ornithosis agent were able to fight the infection.☆

REMOVING THE THYMUS

Veterinarians improve surgical techniques to study role of the thymus in young calves

Improved surgical techniques developed by ARS veterinarians help reveal the role played by the thymus gland in maintaining normal growth of young calves during their first few weeks of life.

As a result, new ways—a hormone, for example—may eventually be developed to help dairymen avoid "nonspecific," but often costly, diseases of young calves.

The research on thymuses of calves began after experiments on young offspring of laboratory animals revealed that the thymus is needed for proper growth. Mice, hamsters, and rats without thymuses are marked by poor growth, ruffled hair, hunched posture, and diarrhea. These symptoms, collectively known as "wasting syndrome," have also been noted in so-called "unthrifty" or "runty" calves, leading ARS scientists to believe that a defective thymus might also be involved.

To check on this possibility, physiologists must first determine the normal function of the thymus. Only when gland functions are understood can malfunctions be diagnosed and a remedy be tested.

Carrying out this investigation requires surgical removal of the thymus—an operation called thymectomy—from a considerable number of calves. Performance of operated animals is measured against that of another group of calves which have undergone a sham operation—a surgical procedure that simulates a thymectomy but leaves the thymus intact.

A team of ARS veterinarians, including G. L. Coleman, M. L. Crandall, and F. E. Sterner, cooperated in developing and performing surgical procedures to minimize stress on the subjects. This was quite a challenge, because the thymus gland in cattle is not found in one compact location.

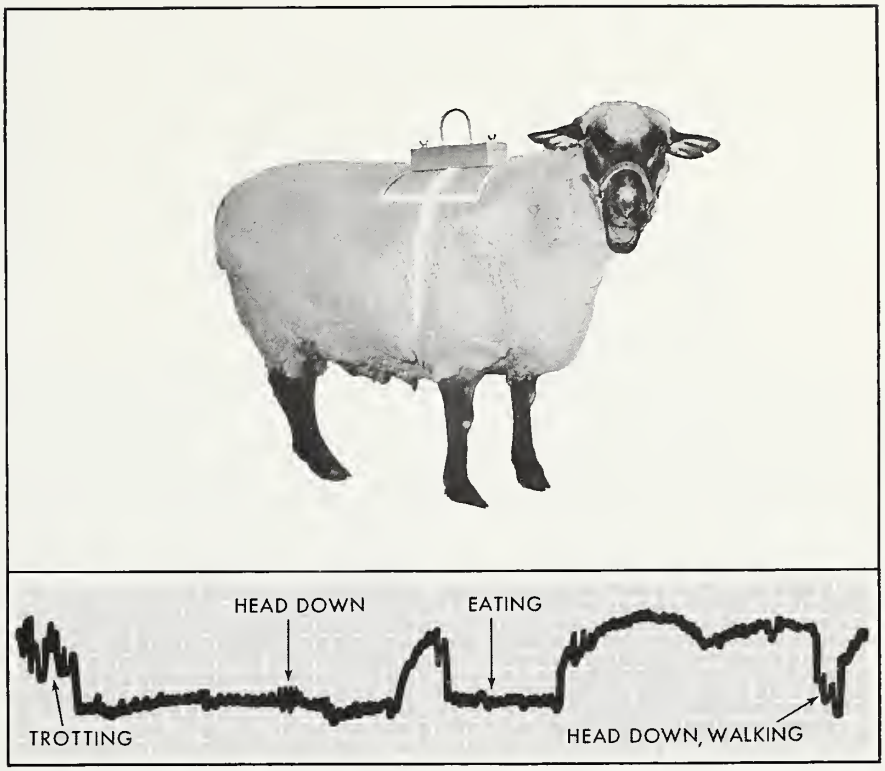
About two-thirds of the thymus gland stretches from the top of the thoracic cavity (upper chest) into the neck, forming two strands along opposite sides of the trachea (or windpipe). Surgeons must remove some hard-to-find, very thin bands or clumps of cells, especially in the most forward part of the gland.

The remainder of the gland lies more compactly near the heart, and its removal—though less tedious—has necessitated entirely new techniques. Veterinary surgeons previously entered the chest cavity by cutting directly through the breast bone. But this technique is quite hazardous, because the carotids, major arteries that supply blood to the head, are too close to the area in which surgeons have to work.

Therefore, the ARS veterinarians devised a new and safer approach through the ribs. It lessens the danger, not only to major blood vessels, but also to important nerve fibers.

The surgeons have completed 13 true thymectomies, so far—each of which takes 2 to 3 hours—as well as 12 simulated thymectomies for research controls. About 36 hours after surgery, the young animals move about normally, without apparent stiffness. They make good subjects for studying the thymus.☆

Having completed the thymectomy operation, veterinarians Coleman, Sterner, and Crandall (left to right) suture muscle layers together in the process of closing the incision. (Photo No. N–57959)



A motion transducer transmitter permits ARS scientists to keep tabs on a sheep's activity without visually observing the animal. Radio signals are translated into graph form. (Photo No. BN–26677)

TRANSMITTING ANIMAL MOTION

Laboratory tool automatically records when animals eat, stand, lie, walk, trot, gallop

■ ARS scientists can now tell what an animal is doing without watching it—in physiopathological studies at the National Animal Disease Laboratory, Ames, Iowa. Watching for them is a small, 1⅓-ounce, electronic instrument called a motion transducer transmitter (MTT), designed and built by ARS engineer A. J. Stattleman and technician H. M. Cook. (See also "Transmitting Animal Health," AGR. RES., December 1965, p. 7.)

The MTT could also be used on humans and might serve as a warning system, for example, to alert a hospital nurse when a patient needs immediate attention.

The heart of the invention is a transducer or variable capacitor, consisting of half circle brass plates attached to each side of a sealed plastic cylinder half filled with oil. Movement of the oil alters the frequency of radio waves sent from a tiny battery-operated transmitter to a standard F–M receiver hooked to a recorder.

The receiver and recorder translate the altered radio signals into graphs that depict the animal's movements. If the MTT were placed on a table, for example, the steady signal transmitted would be recorded as a flat line. Placed on a still animal, the MTT signal would be slightly altered by the animal's breathing. And, if the animal was moving about, the signal would become more variable and be recorded as a jagged up-and-down line.

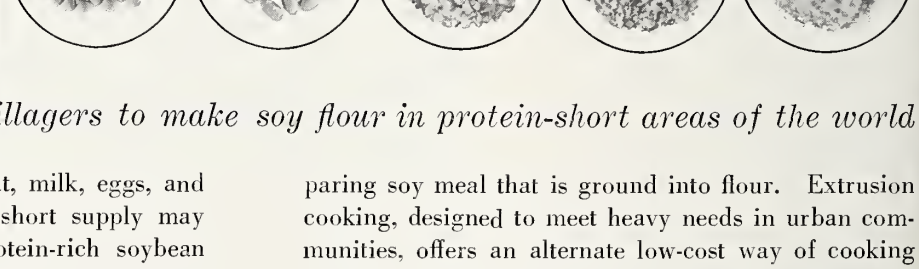
Stattleman and Cook tested their invention by placing it on a sheep, cow, and pigeon. After correlating visual observation with radio signals sent by the transmitter, they were able to make accurate record interpretations.

They could tell by reading the record, for instance, if the sheep was standing, lying, walking, trotting, galloping, or eating. The cow's respiration rate was observed during surgery. The scientists also knew when the pigeon walked, flew, and landed. On each of these animals the MTT was fastened securely to prevent slippage and false motion.

Also, when placed on the chest of a sleeping child, the device observed respiration equally well. There was a slight interruption of the signal when the infant rolled over, but accurate transmission resumed when the MTT was placed on the child's back.☆

SOYBEAN FLOUR

IN FIVE EASY STEPS



An inexpensive way for villagers to make soy flour in protein-short areas of the world

■ Villagers in countries where meat, milk, eggs, and other animal-protein foods are in short supply may some day learn how to make protein-rich soybean flour—in five easy steps developed by ARS engineers.

The work is one phase of a broad developmental effort by USDA scientists to provide high-protein and high-energy foods for people in developing countries.

Financed by the Agency for International Development (AID), the soy flour process has been developed by ARS engineers W. J. Albrecht, G. O. Mustakas, and E. L. Griffin, Jr., at the Northern utilization research laboratory, Peoria, Ill.

Using inexpensive and readily available equipment (see photo steps, right), the soy flour process discards only the hulls in converting soybeans to full-fat flour. The end product is about 20 percent fat and 40 percent protein, which is expected to be used in beverages, soups, and various cooked dishes. Other research has shown that soybean protein has more of the essential amino acids than protein of wheat, corn, or rice.

Food evaluation under the AID–ARS project is providing information on the nutritive value of the soy flour; its use in foreign foods; how it can be formulated into such foods as beverages and gruels for infants and children; and the acceptability, home preparation, and use of these foods.

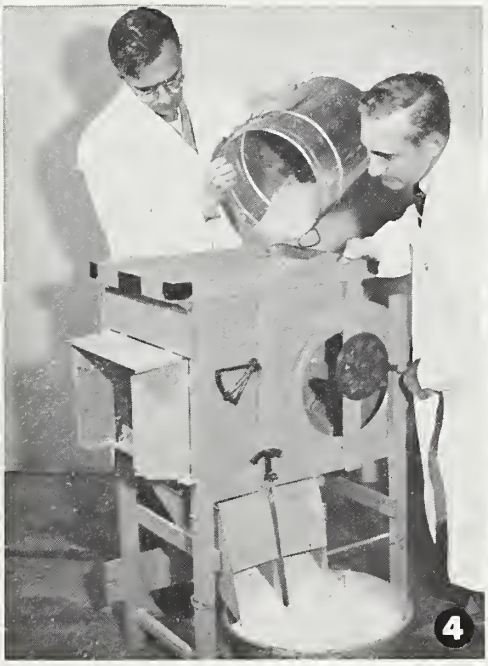
The development of the five-step process follows other research on industrial-type extrusion cookers for preparing soy meal that is ground into flour. Extrusion cooking, designed to meet heavy needs in urban communities, offers an alternate low-cost way of cooking soybeans for use as soy flour in foreign countries.

Foreign technicians are being trained under the AID–ARS project to insure that the processes developed will immediately begin enrichening protein-poor diets.

To assist in the studies, food technologists and mechanical engineers Hsi-Lin Chen and Ching-Tang Yeh from Taiwan, and D. T. Salon from the Philippines, are now training at the Peoria laboratory. Their training is under the sponsorship of the United Nations Children's Fund (UNICEF).

The soy flour project is an outgrowth of ARS–UNICEF research started in 1963. Methods were developed to produce soy flour in industrial-type equipment on a scale large enough to feed people in urban areas. The flour, tested clinically in Taiwan, was found satisfactory, but an easier method of producing it was needed for villages and farms. Thus, the five-step process was born.

Earlier soybean food studies at the Northern laboratory include the processing of Japanese miso and tofu (AGR. RES., March 1960, p. 5) and Indonesian tempeh. Brazilians, as well as Indonesians, studied tempeh making. ARS is supporting Public Law 480 research on foods in Israel, Japan, and Taiwan.☆



In the five-step process, soybeans are (1) soaked overnight in water containing 1 percent soda bicarbonate, and boiled 10 to 15 minutes; (2) air dried; (3) cracked; (4) dehulled; and (5) ground into flour. Soaking shortens cooking and provides the right moisture content without close supervision. Brief cooking in boiling water sterilizes the beans, and deactivates growth inhibitors without removing protein. (Photo Nos. PN–1345, PN–1346, PN–1347, PN–1348, PN–1349)

Other High-Protein Foods Are Also Being Developed

ARS is developing several new food-protein sources from soybeans, cottonseed, and peanuts . . . a peanut-flour wafer made without milk and eggs, a beverage containing soy flour for babies and small children, a soft food for babies made with oilseed flour, and a vegetable stew thickened with oilseed flour.

Scientists and engineers from developing countries are working with ARS, and visitors and student groups are evaluating the new foods for acceptability in their countries and to suggest ways the flours can be used in their own popular dishes.

Engineers test the alfalfa leaf stripper (photo, left) before equipping it with a flail-type forage chopper to blow leaves into a trailing wagon. After a second crop of leaves have been stripped (photo, above), stems are harvested for roughage. (Photo Nos. PN–1342 and PN–1343)

Now it's an alfalfa . . .

LEAF STRIPPER

Test machine strips leaves from stems, later restrips second growth from same stems

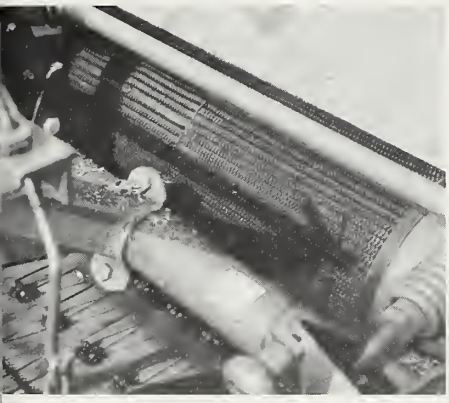
■ Every alfalfa grower who has wished for a way to prevent heavy leaf loss at harvest time may find the answer to his problem in an experimental machine now being developed.

The tractor-drawn unit strips and collects leaves—up to 90 percent of them in field tests. Stripped stems regrow another set of leaves, which again can be stripped.

Regrowth studies are still preliminary, but engineers think it may be possible to strip twice, then harvest the stems as roughage. If this proves to be the case, the new harvest method would greatly increase the value of the crop. The leaves make a high-protein, low-fiber feed ideally suited to processing into meal or pellets, and the stems make a useful roughage.

The leaf-strip harvester was designed by agricultural engineer H. D. Currence of ARS, while a graduate assistant at Iowa State University, and W. F. Buchele of the Iowa Agricultural Experiment Station, Ames.

The experimental machine, a modified version of a commercial hay crusher, is equipped with a windrow pick-up attachment from a combine which serves as a feeding device to properly position plants for stripping. The stripping mechanism consists of two modified crusher rolls, a 12-inch



Rubber door matting, with alternate rows of finger-like projections removed, is mounted on the upper roll of modified hay crusher to strip alfalfa leaves. (Photo No. PN–1344)

upper roll of smooth steel and an 8-inch lower roll on which rubber door mats have been mounted (see photo).

Spacing between the rolls and the speed of rotation of the rolls can be set to control the amount of stems in the stripped product. and thus control the quality of the product. Originally a box behind the rolls collected the leaves as they were stripped from the stems, but in 1965 G. E. Ayres of the Iowa Station mounted the leaf-stripper on a modified flail-type chopper, which elevates and transports the leaves to a trailing wagon.

The scientists field-tested the leaf-strip harvester during the 1965 season and studied regrowth patterns of alfalfa leaves. Feeding trials using the stripped leaf product are now being conducted.☆

Hog Cholera Eradication:

Fourteen More States To Enter Final Phases

■ Before the end of 1966, 14 additional States expect to join those 17 now engaged in the final two phases of the four-phase hog cholera eradication program.

Each phase in the eradication campaign represents a gradual buildup in a State's fight against hog cholera—until the disease is wiped out. The first two phases are aimed primarily at control to reduce the incidence of the disease to as low a level as possible—through shipping rules, prompt reporting, quarantines, and other measures.

Then, the "stamping out" procedures of the final two phases can be applied. These provide for cooperative State-Federal indemnity payments to help locate and wipe out infected herds.

At the beginning of 1966, all States were in the eradication program, and 29 States, having nearly 90 percent of the hogs, were in phase II. ARS officials point out that the 14 States moving into phase III during 1966 have over 67 percent of the country's swine and include the top six States in hog production.

Success of the control phases during 1965—especially in the big hog-producing States of the Midwest—is reflected in the hog cholera outbreak totals. The Nation as a whole reported 21 percent fewer confirmed outbreaks of hog cholera in 1965 than in 1964, dropping to 881 cases from 1,117.

Decrease in the Midwest was even greater—55 percent—where the top 10 States in hog marketings reported only 288 confirmed outbreaks last year compared to 633 in 1964. This large decline was offset somewhat by increases in several southern and southeastern States.

ARS officials explain that the indemnities used in phase III and IV help dispose of infected herds rapidly—a necessary step in the eradication of hog cholera. Thus, they say, by removing sources of infection as quickly as possible, these payments protect the vast majority of producers, those with healthy pigs.

The goal is for all States to be in phase III or IV by the end of 1967. Based on a survey of veterinary officials at the end of 1965, a total of 43 States—containing more than 95 percent of the Nation's hogs—now anticipate meeting or beating this goal.

G. H. Wise, veterinarian in charge of hog cholera eradication for ARS, emphasizes that prompt reporting of all illnesses suspected of being hog cholera is even more essential as States reach the final phases of the program. It is also important to maintain a high level of vaccination in those areas where hog cholera continues to be a problem.

"Target date for a 'hog cholera free' United States is 1972," Wise continues. "Five States—Alaska, Montana, Nevada, Utah, and Vermont—have already achieved this status. If everyone does his part, the entire country can meet this goal."☆

BULL MILK

PROVIDES CLUES TO INHERITANCE

Scientists refine techniques to identify milk proteins and their mode of inheritance

EDITOR'S NOTE: *Dairy scientists are studying various forms of milk proteins—products of mutant genes—to learn more about the mechanism by which genes control protein synthesis. (AGR. RES., June 1965, p. 6).*

Although not much is now known about their practical significance, mutations found to produce desirable (or undesirable) characteristics in milk could in time be propagated (or eliminated) by selective breeding.

■ Two-year-old bulls, steers, and 6-month-old male calves are producing milk in ARS research trials to furnish clues for tracing the inheritance of rare milk proteins.

Injected with the hormones estrogen and progesterone, these animals yield only a small amount of milk: the highest producer, a bull calf, is now giving one-half ounce of milk a day. The effect of the hormone is temporary, lasting only as long as the dairy scientists continue injecting the hormones.

Scientists such as ARS dairy geneticist C. A. Kiddy in Beltsville, Md., and chemist M. P. Thompson in Philadelphia, Pa., have worked for 10 years at refining techniques to identify milk proteins and their mode of inheritance. For genetic studies, these microconstituents are useful in much the same way as human blood groups, such as the A, B, and O series.

One milk protein, alpha$_{s1}$ casein, appears in one of three forms labelled A, B, or C. Most cattle have milk with the B and C type, but because of a recently discovered mutation, a few AB types (having both A and B variants in their milk) have been identified.

The pure-A type is rarest, and a 9-year-old Holstein from Michigan named Marie is the only known survivor with pure-A milk. Therefore, ARS, which now owns Marie, is most anxious to obtain a pure-A calf from her for future studies.

"We bred Marie to an AB bull," geneticist Kiddy says, "which gave us a 50–50 chance of getting a pure-A calf."

Kiddy explains that since Marie is pure-A, she transmits only A genes. There is no known pure-A bull, so the only way to get a pure-A calf would be to use an AB bull to transmit either A or B genes. If he contributes an A gene, the desired pure-A calf results. The B gene would produce another AB calf—much less desirable for the milk protein studies.

When Marie gave birth to a bull calf last November, Kiddy was anxious to find out whether Lady Luck had been on his side and had invested the little bull with two A genes.

Ordinarily, it would have taken years to find the answer. After the bull matured, he would have to be mated to several cows of known type. Then, when daughters from these matings started milking, the bull's type would have been deducible.

To speed the work, Kiddy tried a previously developed method of injecting steers with the hormones estrogen and progesterone to cause the mammary gland to develop. Milk thus produced proved to be almost indistinguishable from cow's milk. Kiddy could determine a steer's milk protein type directly—and thus verify the classification assumed for the steer from chemical tests that have been made on milk supplied by the steer's female relatives.

The hormone treatment had to be continued about 6 months before milk could be collected. But Kiddy hopes to shorten this time with simplified techniques.

The techniques used on steers also worked with mature bulls without reversing the normal male characteristics of the bulls.

When 6-month-old bull calves also demonstrated that they could deliver milk—by outproducing even mature bulls and steers—it seemed safe to go ahead with the original aim of typing Marie's bull calf. Disappointingly, the calf's alpha$_{s1}$ casein type turned out to be AB, not pure-A, as was hoped.

The researchers are now concentrating on Marie's next calf, which is due soon. Again, there is a 50–50 chance that it will have a pure-A milk type. With luck, this calf will be the answer to Kiddy's hope that the only known source of pure-A milk will not die with Marie.☆

CONTROL PARASITES WITH CORN?

Parasitologists seek reasons why few larvae develop on pastures to reinfest calves when the calves are fed a corn ration

■ When calves are fed a ration that includes as little as 30 percent corn by weight, few larvae of worm parasites develop on pastures to reinfest the calves. This condition apparently results from an increase in carbon dioxide caused by fermentation of corn meal in calf droppings.

These conclusions are based on a long series of experiments conducted by ARS parasitologists Honorico Ciordia, W. E. Bizzell, and D. A. Porter in cooperation with the State Agricultural Experiment Station at Experiment, Ga., and the ARS Regional Laboratory, Auburn, Ala.

About 10 years ago, these scientists conducted experiments on how different pasture crops affect internal parasites of cattle. In one test, when calves were given a little corn along with the pasture, they had about half as many worms as the calves that got no grain.

The conclusion drawn from this experiment was that the grain-fed calves did less grazing and, therefore, picked up far fewer worm larvae from the pasture.

To check this theory, calves were artificially infested with any one of six common worm parasites and fed an all-grain or all-hay ration.

When these calves were fed the all-grain ration (shelled corn 90 percent, soybean meal 8 percent, trace mineralized salt 2 percent) the average number of larvae that hatched from worm eggs recovered from their feces ranged from 0 to 7.6 percent. When the same calves were fed an all-hay ration, the range was 21 to 55.5 percent.

These results indicate that the corn somehow prevented the parasites from developing.

Or did it?

To find out, the scientists collected droppings from hay-fed calves infested with two species of hairworms. Half of the droppings were mixed with sphagnum moss and the other half with sphagnum moss and corn. No larvae were recovered from cultures containing the corn. Larval recovery averaged 58 and 26 percent for the two worm species in the grain-free cultures.

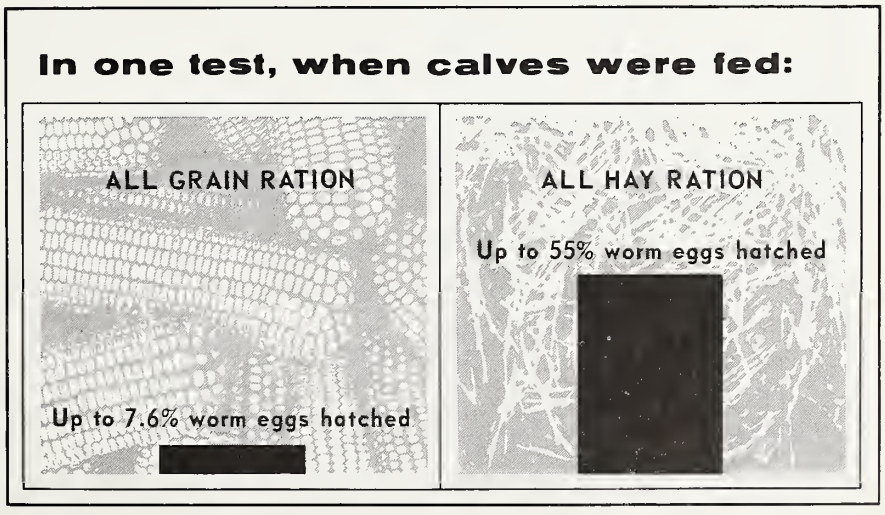
They conducted a similar experiment using undigested corn from droppings of a parasite-free calf. When this corn was added to droppings (30 percent corn by weight) from a hay-fed calf infested with hairworms, no larvae were recovered from the resulting cultures. But in cultures of the same droppings without corn, 48 percent of the eggs hatched into infective worm larvae.

The research team then knew that something in corn was affecting worms, but what? To find out, they tested the effect of various corn products on the development of worm larvae.

In cultures, they mixed the amount of corn product normally found in a ration containing 30 percent corn by weight.

Results showed: 26.9 percent larval recovery from control cultures (no corn), 3.3 percent from cultures with corn starch, 31.4 percent from cultures with corn oil, 4.5 percent from cultures with corn steep, and 0 from cultures with corn meal.

Whether these results can be used profitably by cattlemen is yet to be determined. The parasitologists say that ranchers in the southeastern States might find feeding corn supplements helpful because calves are raised there on winter pastures when worm parasites are troublesome. They caution, however, that they have not tested corn additives in the rations of large numbers of calves with mixed infestations of parasites. Until they do, they're not sure what amount of parasite control can be expected.☆



SURVIVAL OF BACTERIA . . .

In Mechanical Dishwashing

■ Home-type mechanical dishwashers, although not designed for sterilizing dishes, sanitized almost all eating utensils satisfactorily in recent ARS experiments.

Microbiologists Ethel McNeil, Eva Choper, and R. R. Banville washed the dishes and utensils in three types of machines at Beltsville, Md., followed by a precise technique developed by the scientists to determine the number of bacteria on utensils surviving the wash, rinse, and dry cycles.

The researchers prepared two types of breakfasts, using foods ordinarily consumed in homes. Items served included orange juice, milk, fried eggs, cereal, creamed chipped beef on toast, butter, jam, and coffee.

After the meal was prepared and eaten, the dishes were allowed to remain at room temperature for 1 hour. Each was then lightly wiped, with a different paper napkin for each utensil. At this point, all utensils—china, earthenware, plastic dishes, and stainless steel flatware—were washed, rinsed, and dried in the dishwashers.

The microbiologists held the temperature of incoming wash water at 140° F. When the drying temperature inside the machines had dropped to 100° F., they removed and tested the dishes for the presence of bacteria.

Instead of using the conventional cotton swab technique, the researchers placed the utensils in plastic tubes and sealed them with aluminum foil. This allowed the bacteria to grow directly on the surface of the utensils. For demonstrating the number of bacteria on plates and saucers, bacteriological culture media was placed directly on specified areas.

In evaluating results, the scientists regarded more than 100 bacteria colonies in the area sampled on each utensil as unacceptable cleaning. On this basis, only 0.3 percent of the utensils taken from the automatic washers were unacceptable. Of a smaller number of hand-washed plates, on the other hand, 19 percent were unacceptable.

No appreciable differences in bacteria counts were noted between the different types of dishes or between mechanical dishwashers.☆

In Commercial Drycleaning

■ Drycleaning does not disinfect fabrics, say USDA microbiologists Robert Banville and Ethel McNeil, who recently completed a bacteriological study of drycleaning processes at a large commercial drycleaning plant.

Conducted as part of an ARS research program on household hygiene, the study was basically concerned with the spread of microorganisms on textiles and clothing. Publication of results of studies on the microbiology of home-type laundering had met with considerable consumer response—and led to similar questions about drycleaning processes.

The scientists found that many of the bacteria on fabrics are killed or removed by washing in solvent, but others manage to survive the wash cycle. Of those remaining, the majority are killed during steam finishing and pressing—if these steps are employed.

Many garments are not steam treated, however, as when a coin-operated machine is used. And even when garments are pressed, bacteria survive in such places as sleeves and pocket linings because these areas are not subjected to as high a temperature as the rest of the garment.

The study indicated also that bacteria may wash off heavily contaminated garments during cleaning and transfer to relatively clean fabrics in the same load. Bacteria were not carried over in large numbers, on the other hand, from one load to another.

Although only a few harmful bacteria were found in normal loads of drycleaned garments, a large proportion consisted of forms related to certain disease-causing species. This finding suggests that disease-producing varieties—when they are present—might also survive and transfer from one article to another.

More research would be needed, the scientists add, to determine how many harmful bacteria are being spread through present processing methods and whether changes in current practices are necessary. Meanwhile, drycleaning should not be regarded as a means of cleaning or disinfecting fabrics believed to be contaminated with harmful bacteria.☆

A clue to leaf beetle resistance

A finding in a Michigan study may provide an important clue for plant breeders attempting to develop small grain varieties resistant to the destructive cereal leaf beetle. The finding: Leaves with hairy surfaces repel egg laying by cereal leaf beetles.

The investigators also noted that, in general, wheat resists infestation better than oats or barley. The outlook, then, is that resistant wheat varieties will be less difficult to develop than resistant oat and barley varieties.

First identified in Berrien County, Mich., in 1962, the cereal leaf beetle has since been found in Ohio, Indiana, and Illinois. A joint Federal-State control and regulatory program, started in 1963, has kept damage to a minimum and has slowed the rate of spread. The beetle is extremely destructive to oats, wheat, and barley in both the adult and larval stages.

In searching for resistant varieties, ARS and Michigan Agricultural Experiment Station scientists planted 687 varieties of wheat, oats, and barley. After releasing a heavy population of adult cereal leaf beetles in the test plots to supplement natural infestations, they observed oviposition (egg laying) and larval and adult feeding.

About twice as many eggs were laid on oat and barley varieties as on wheat. However, even in the oats and barleys, most varieties with less than one egg per plant had pubescent (hairy) leaves.

Adult feeding and larval feeding were more severe on oats and barley than on wheat. The scientists rated adult feeding damage in the "trace to little" category on 36 percent of the wheat varieties—lower than any of the oat or barley varieties. There was less difference among oats, wheat, and barley in larval feeding, but the wheats in general had less damage.

Only one of the 687 varieties (a 14-chromosome wheat, *Triticum persicum* Vavilov) was highly resistant. No eggs were laid on this variety, and it had only a trace of damage from adult and larval feeding. It has an exceptionally hairy leaf surface.

Beetles shy from light, are trapped

A scientific tool, the Berlese funnel, has been modified for use by ARS plant quarantine inspectors to help detect khapra beetles and other tiny insects in ships' holds and cargoes.

Adapted by E. J. Ford, Jr., a plant quarantine inspector at Baltimore, the funnel supplements normal visual searches by exploiting a natural habit of this beetle—its tendency to shy away from light. When carefully used by an alert, well-trained inspector, the funnel catches even the most elusive bugs.

One of the world's worst pests of stored grain, the khapra beetle is extremely difficult to detect. It can go without food for several years—a characteristic which permits it to infest or contaminate almost any type of cargo for extended periods.

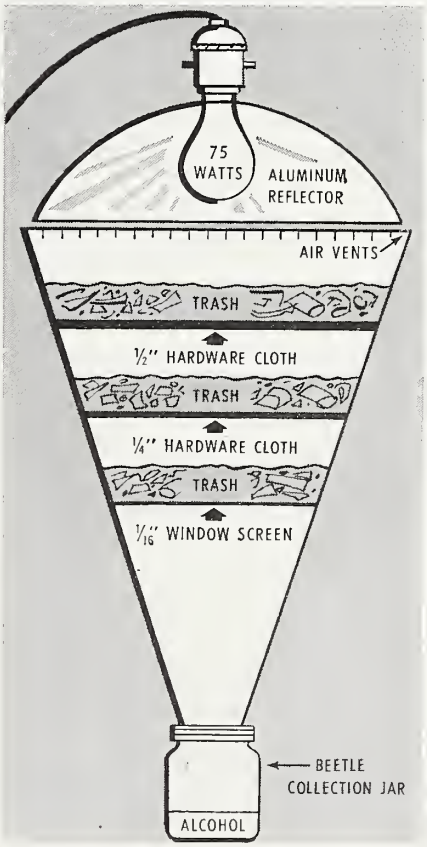
The modified funnel is especially valuable for detecting small numbers of these insects which are scattered throughout a large quantity of cargo or trash. Of 462 khapra beetle interceptions last year, about one-third were found in ships' holds or stores. Several interceptions were made only after the funnels had detected an infestation.

Successful operation of the funnel involves driving the khapra beetles in a grain sample away from a light source. Samples suspected of containing insect pests are spread over three screens installed at levels within the funnel. Each screen is composed of a different mesh—½, ¼ and 1/16 inch—to insure proper separation of the debris. The light source is a bulb installed above the top screen.

As the insects retreat from the light, they drop downward through the three screens and are funneled into a collecting jar. This process usually takes 1 or 2 hours, depending on the coarseness of the material.

Samples being processed should be representative of cargo as a whole.

(*Photo No. BN–27007*)



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AGRISEARCH NOTES

Sunlight kills microbial spray

ARS scientists now think they can explain why the bacterium *Bacillus thuringiensis* controls certain insects better when applied in a dust rather than in clear water as a spray.

Sunlight, the researchers have found, deactivates the spores. When used as a carrier, dust may shield the spores from sunlight, the scientists think, and thus help keep them viable longer.

In studies at Beltsville, Md., entomologist G. E. Cantwell and agricultural research technician B. A. Franklin found that sunlight killed 59 percent of the spores exposed for half an hour and more than 80 percent of those exposed for an hour. In view of these findings, the researchers say, there is little wonder that results with *B. thuringiensis* in the field have not always agreed with the results of laboratory tests.

The bacterium is now recommended for use against tobacco budworms and hornworms, and it has been tested against the cabbage looper, tomato hornworm, and gypsy moth. From results so far, it looks promising as a biological control agent.

As a next step, the researchers will investigate various dusts to see which gives spores the best protection from sunlight. Among the materials now commonly used as carriers are diatomaceous earth, talc, organic flours, and minerals such as lime and gypsum.

In addition to shielding the spores from the sun, dusts give more uniform coverage, particularly on the under surface of the leaf, where certain insects usually feed.

Luring cabbage loopers into traps

Male cabbage loopers are even more susceptible to female-baited light traps than are tobacco hornworms.

In California field tests, ARS entomologists T. J. Henneberry and A. F. Howland found that black light traps baited with virgin female cabbage looper moths caught about 20 to 30 times as many males as similar unbaited traps. This compares with about a dozen times as many male tobacco hornworms trapped in earlier tests (AGR. RES., April 1965, p. 15).

Unbaited traps located 20 feet from the baited ones caught 10 to 15 times as many cabbage looper moths as did isolated, unbaited traps. Female-baited, unlighted traps attracted fewer male moths, indicating a need for both factors—light and female moths.

In earlier laboratory tests with extracts of female sex attractant, the scientists showed that more male cabbage looper moths responded to black light in combination with the extract than to the sex attractant or to the black light alone.

Although much research remains, the tests do indicate the feasibility of controlling cabbage loopers by this method. Until now, black light has not been considered a control measure. Additional tests may also indicate the possibility of using the combination method to attract males (there seems to be little effect on females) to the traps where a chemoserilant material might be introduced—thus offering the potential for effective biological control.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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